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No. 12—1915.

British Engineering Standards Association.

(*Incorporated 1918.*)

FORMED IN 1901 AS THE ENGINEERING STANDARDS COMMITTEE

BY

THE INSTITUTION OF CIVIL ENGINEERS.
THE INSTITUTION OF MECHANICAL ENGINEERS.
THE INSTITUTION OF NAVAL ARCHITECTS.
THE IRON AND STEEL INSTITUTE.
THE INSTITUTION OF ELECTRICAL ENGINEERS.

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STANDARD SPECIFICATION

FOR

PORTLAND CEMENT.

(REVISED MARCH, 1915.)

LONDON:
PUBLISHED FOR THE ASSOCIATION BY CROSBY LOCKWOOD & SON,
7, STATIONERS' HALL COURT, LUDGATE HILL, E.C. 4; AND 3, BROADWAY, LONDON, S.W. 1,
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January, 1919.

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BRITISH ENGINEERING STANDARDS ASSOCIATION.

MAIN COMMITTEE.

† SIR ARCHIBALD DENNY, BART. (*Chairman*).

SIR MAURICE FITZMAURICE, C.M.G. (*Vice-Chairman*).

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SIR WILLIAM MATTHEWS, K.C.M.G.	
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MR. F. W. GILBERTSON...	
HON. SIR CHARLES PARSONS, K.C.B. ...	Co-opted by the nominated Members.
SIR ROBERT HADFIELD, BART.	
SIR RICHARD GLAZEBROOK, C.B.	

DR. J. H. T. TUDSBERY (*Hon. Secretary*).

MR. C. LE MAISTRE (*Secretary*).

MR. CHARLES DRESSER (*Assistant Secretary*).

† Succeeded the late SIR JOHN WOLFE BARRY, K.C.B., February, 1918.

BRITISH ENGINEERING STANDARDS ASSOCIATION.

The following is the list of Members of the Sectional Committee on Cement which was entrusted with the present revision of the Standard Specification.

SECTIONAL COMMITTEE ON CEMENT.

March, 1915.

Chairman, Sir William Matthews, K.C.M.G. (*Representing the Crown Agents for the Colonies*).
Admiralty, Mr. T. Sims, C.B.
India Office, Mr. W. E. Phelps, I.S.O.
Royal Institute of British Architects, Mr. Lewis Solomon.
Institute of Chemistry, Mr. Bertram Blount.
London County Council, Mr. G. W. Humphreys.
Port of London Authority, Mr. C. R. S. Kirkpatrick.
Concrete Institute, Mr. H. W. Anderson.

Sir Maurice Fitzmaurice, C.M.G.; Sir Francis Fox (*Sir Douglas Fox and Partners*); Mr. H. K. G. Bamber, Mr. E. W. Brooks, Mr. H. E. Brooks (*Associated Portland Cement Manufacturers (1900), Ltd.*); Mr. W. J. Cooper; Mr. A. C. Davis, Mr. C. H. Watson (*British Portland Cement Manufacturers, Ltd.*); Mr. H. Howard Humphreys (*Cement Users' Testing Association*); *Mr. Arthur Jackson (*Sir John Jackson, Ltd.*); Mr. E. D. Jones (*Topham, Jones & Railton, Ltd.*); Mr. Anthony G. Lyster (*Sir John Wolfe Barry, Lyster & Partners*); Mr. Charles S. Meik, Mr. E. E. Pearson (*S. Pearson & Son, Ltd.*); ‡Mr. W. W. Squire (*Bristol Docks*); Mr. F. E. Wentworth-Sheilds (*Southampton Docks*); Mr. Maurice F. G. Wilson (*late Dover Harbour Works*); Mr. W. B. Worthington, *Engineer-in-Chief, Midland Railway*); †Mr. G. N. Yourdi (*late Birmingham Water Works*).

Mr. A. A. Hudson, K.C. (*Standing Council to the Committee*).

* Succeeded Mr. J. J. Warbrick, November, 1914.
† Deceased September, 1914.
‡ Deceased January, 1915.

PREFACE TO FIRST EDITION.

The Committee on Cement was appointed at a meeting of the Main Committee on March 27th, 1903.

The first meeting of the Committee was held on June 12th, 1903, at which meeting the Chairman and Mr. Bertram Blount kindly consented to draw up a draft Specification for the consideration of the Members.

The Committee has held, in all, twelve meetings, and has collected a large amount of information from Engineers, Manufacturers and Consumers of Cement, which information has been carefully collated, and considered by the Committee during their deliberations.

The Specification was passed in its final form by the Committee at a meeting held on November 23rd, 1904.

This Report was approved by the Main Committee at their Meeting on December 8th, 1904.

WM. MATTHEWS,

Chairman of the Sectional Committee on Cement.

PREFACE TO SECOND REVISION.

Since the issue of the first revision of the Specification the Committee has continued its investigation into the question of the determination of the initial setting time of cement. It was found that while the final setting times determined by the British Standard and Vicat Needles approximated very closely, the initial setting time as determined by the British Standard Needle differed considerably from that given by the Vicat Needle which is in general use, and also from that obtained by the rough and ready test of the finger nail.

It was considered preferable that one instrument only should be specified for determining the initial and final setting times of cement, and the Vicat Needle has been adopted for that purpose.

The Committee has also considered the question of inserting a clause in the Standard Specification to provide against the expansion of cement in cold water, but as the result of experimental investigation, they recommend that no test of the plunging type be inserted, as it depends upon the setting time of the cement rather than upon its soundness.

In regard to chemical composition, a minimum lime content has been inserted with a view of excluding cements other than Portland Cements, the total loss on ignition has been specified

to provide an additional criterion of the quality of the cement and to restrict the amount of water present, and provision is now made for limiting the total amount of sulphur present in the cement whether in the form of sulphides or sulphates.

The instructions for gauging cement have been slightly modified with a view of removing as far as practicable any ambiguity as to the actual consistency of the cement which may have existed under the previous instructions, and the growth of tensile strength of cement and sand briquettes has been graded in a similar manner to that of neat cement briquettes.

The text of the Specification has been subjected to scrutiny by Mr. A. A. Hudson, Barrister-at-Law, with a view to ensuring that as far as practicable it has the meaning the Committee intended it should have, and the Specification has been re-modelled in accordance with his advice.

The Specification in its present form was approved by the Sectional Committee on April 20th, 1910, and by the Main Committee on June 10th, 1910.

WM. MATTHEWS,

Chairman of the Sectional Committee on Cement.

PREFACE TO THIRD REVISION.

Since the issue of the second revision of the Standard Specification in 1910 the Committee have found it necessary to provide for the preparation of cement of increased fineness, and they have accordingly reduced the permissible residue on the 180 × 180 sieve from 18 to 14 per cent., and that on the 76 × 76 sieve from 3 to 1 per cent.

The Committee have found it desirable to raise the specified tensile strength of the cement, and have increased the minimum average breaking strength of the neat cement briquettes, at 7 days after gauging, from 400 to 450 lbs. per square inch, and the minimum average breaking strength of the cement and sand briquettes at 7 days after gauging from 150 to 200 lbs. per square inch.

Some other alterations have also been made with a view to improving the quality of the material.

The Specification in its present form was approved by the Sectional Committee in December, 1914, and by the Main Committee on March 18th, 1915.

WM. MATTHEWS,

Chairman of the Sectional Committee on Cement.

NOTE.—*This Specification defines the Standard quality of cement and various matters relative thereto, but does not include the provisions necessary for a contract for the sale or use of cement.*

BRITISH STANDARD SPECIFICATION FOR PORTLAND CEMENT.

(REVISED MARCH, 1915.)

Composition and Manufacture of Cement.

1. The cement shall be manufactured by intimately mixing together calcareous and argillaceous materials, burning them at a clinkering temperature and grinding the resulting clinker, so as to produce a cement capable of complying with this Specification.

No addition of any material shall be made after burning other than calcium sulphate, or water, or both, and then only if desired by the Vendor* and not prohibited in writing by the Purchaser.

Samples for Testing and by whom to be taken.

2. A sample or samples for testing may be taken by the Purchaser or his representative, or by any person appointed to superintend the works for the purpose of which the cement is required or his representative, or by any expert analyst employed or instructed by such Purchaser or person, or the representative of such Purchaser or person.

Samples for Testing and how to be taken.

3. Each sample for testing shall consist of approximately equal portions selected from twelve different positions in the heap or heaps when the cement is loose, or from twelve different bags, barrels, or other packages, when the cement is not loose, or where there is a less number than twelve different bags, barrels, or other packages, then from each bag, barrel, or other package. Every care shall be taken in the selection, so that a fair average sample may be taken.

Sampling Large Quantities.

4. When more than 250 tons of cement is to be sampled at one time separate samples shall be taken, as provided in Clause 3, from each 250 tons or part thereof.

Facilities for Sampling and Identifying.

5. The Vendor shall afford every facility, and provide all labour and materials, for taking and packing the samples for testing the cement and for subsequently identifying the cement sampled.

---

* The term "Vendor" throughout this Specification shall mean the seller of the Cement whether he be the manufacturer of the Cement or not.

Cost of Tests, Analyses and Samples.

6. The tests and chemical analyses hereinafter mentioned, other than those referred to in Clause 16, shall (unless otherwise provided in the contract between the Vendor and the Purchaser) be made at the expense of the Purchaser, but no charge shall be made by the Vendor for the cement used for samples or for carriage thereon.

Tests.

7. The sample or samples shall be tested in the manner hereinafter mentioned for :—

(*a*) Fineness.
(*b*) Specific gravity.
(*c*) Chemical composition.
(*d*) Tensile strength (neat cement).
(*e*) „ „ (cement and sand).
(*f*) Setting time.
(*g*) Soundness.

And before any sample is submitted to tests (*d*), (*e*), (*f*) and (*g*), it shall be spread out for a depth of 3 inches for 24 hours in a temperature of from 58 to 64 degrees Fahrenheit.*

Test for Fineness.

8. The cement shall comply with the following conditions of fineness :—100 grammes or (say 4 ozs.) of cement shall be continuously sifted for a period of 15 minutes on each of the undermentioned sieves and in the order of succession given below with the following results :—

(1) The residue on a sieve $180 \times 180 = 32{,}400$ meshes per square inch, shall not exceed 14 per cent.

(2) The residue on a sieve $76 \times 76 = 5{,}776$ meshes per square inch, shall not exceed 1 per cent.

The sieves shall be prepared from wire-cloth, and the diameter of the wire for the 32,400 mesh shall be ·0018 inch and for the 5,776 mesh, ·0044 inch. The wire-cloth shall be woven (not twilled), the cloth being carefully mounted on the frames without distortion.

Test for Specific Gravity.

9. The specific gravity of the cement when presented by the Manufacturer for testing shall be not less than 3·10.†

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* The temperatures stated are applicable to temperate climates. In other climates special arrangements between Vendor and Purchaser must be made unless the temperature herein stated can be artificially obtained in the laboratory or other place where the tests are made.

† For the determination of the Specific Gravity of Cement the Committee approve the use of a bottle of the form shown on Plate 5.

Test for Chemical Composition.

10. The cement shall comply with the following conditions as to its chemical composition. The proportion of lime to silica and alumina when calculated (in chemical equivalents) by the formula $\frac{CaO}{SiO_2 + Al_2O_3}$ shall be not greater than 2·85 nor less than 2·0*. The percentage of insoluble residue shall not exceed 1·5 per cent.; that of magnesia shall not exceed 3 per cent.; and the total sulphur content calculated as sulphuric anhydride (SO_3) shall not exceed 2·75 per cent. The total loss on ignition shall not exceed 3 per cent.

Test for Tensile Strength (Neat Cement).

11. The breaking strength of neat cement shall be ascertained from briquettes of the shape shown in Fig. 1, Plate I. The briquettes shall be prepared in the following manner:—

Preparation of Briquettes:—The cement shall be mixed with such a proportion of water that the mixture shall be plastic when filled into the moulds used for forming the briquettes.

The cement, gauged as above, shall be filled into moulds of the form required to produce briquettes of the shape shown in Fig. 1, Plate 1, each mould resting upon a non-porous plate. In filling the moulds the operator's hands and the blade of the ordinary gauging trowel shall alone be used. The trowel shall weigh about $7\frac{1}{2}$ ozs. No ramming or hammering in any form will be permitted, nor shall any other instrument or apparatus other than the trowel before described be employed for this operation. The moulds after being filled may be shaken to the extent necessary for expelling the air.

Clean appliances shall be used for gauging, and the temperature of the water, and that of the test room at the time the above operations are being performed, shall be from 58 to 64 degrees Fahrenheit.

The briquettes shall be kept in a damp atmosphere for 24 hours after gauging, when they shall be removed from the moulds and immediately submerged in clean fresh water and left there until taken out for breaking. After they have been so taken out and until

---

* EXAMPLE.—In the case of a cement containing 63·28 per cent. of lime, 21·0 per cent. of silica and 8·16 per cent. of alumina, the proportion of lime to silica and alumina would be as follows:—

Molecular weight of Lime = 56
" " " Silica = 60
" " " Alumina = 102

$$\text{Lime } (CaO) = \frac{63{\cdot}28}{56} = 1{\cdot}13$$

$$\text{Silica } (SiO_2) = \frac{21{\cdot}0}{60} = 0{\cdot}35$$

$$\text{Alumina } (Al_2O_3) = \frac{8{\cdot}16}{102} = 0{\cdot}08$$

$$\text{Then } \frac{CaO}{SiO_2 + Al_2O_3} = \frac{1{\cdot}13}{0{\cdot}35 + 0{\cdot}08} = 2{\cdot}57$$

they are broken the briquettes shall not be allowed to become dry. The water in which they are submerged shall be renewed every seven days and shall be maintained at a temperature of between 58 and 64 degrees Fahrenheit.

Breaking.—The briquettes shall be tested for breaking strength at 7 and 28 days respectively after gauging, six briquettes for each period. The breaking strength shall be the average tensile breaking strength of the six briquettes for each period. The briquettes to be tested shall be held in strong metal jaws of the shape shown in Figs. 2 and 3, Plate 1, and the load shall be steadily and uniformly applied, starting from zero, and increased at the rate of 100 lbs. per square inch of section in 12 seconds.

The breaking strength of the briquettes at 7 days after gauging shall be not less than 450 lbs. per square inch of section.

The breaking strength of the briquettes at 28 days after gauging shall show an increase on the breaking strength at 7 days, and shall be not less than the number of pounds per square inch of section arrived at from the following formula:—

$$\text{Breaking strength at 7 days} + \frac{40{,}000 \text{ lbs.}}{\text{Breaking strength at 7 days.}}$$

Test for Tensile Strength (Cement and Sand).

12. The breaking strength of cement and sand shall be ascertained from briquettes also of the shape shown in Fig. 1, Plate 1. The briquettes shall be prepared in the following manner:—

Preparation of Briquettes.—A mixture of cement and sand in the proportion of one part by weight of cement to three parts by weight of the standard sand specified on page 11 shall be gauged with sufficient water to wet the whole mass throughout without any excess of water being present.

The mixture gauged as above shall be evenly distributed in moulds of the form required to produce briquettes of the shape shown in Fig. 1, Plate 1, each mould resting upon a non-porous plate. After filling a mould a small heap of the mixture shall be placed upon that in the mould and patted down with the Standard Spatula shown on Plate 2 until the mixture is level with the top of the mould. This last operation shall be repeated a second time and the mixture patted down until water appears on the surface; the flat only of the Standard Spatula is to be used, and no other instrument or apparatus is to be employed for this operation. The mould after being filled may be shaken to the extent necessary for expelling the air. No ramming or hammering in any form will be permitted during the preparation of the briquettes, which shall then be finished off in the moulds by smoothing the surface with the blade of a trowel.

Clean appliances shall be employed for gauging, and the temperature of the water and that of the test room at the time the above operations are performed shall be from 58 to 64 degrees Fahrenheit.

The briquettes shall be kept in a damp atmosphere for 24 hours after gauging, when they shall be removed from the moulds and immediately submerged in clean fresh water, and left there until taken out for breaking. After they have been so taken out and until they are broken the briquettes shall not be allowed to become dry. The water in which they are submerged shall be renewed every seven days, and maintained at a temperature of between 58 and 64 degrees Fahrenheit.

Breaking.—The briquettes shall be tested for breaking strength at 7 and 28 days respectively after gauging, six briquettes for each period. The breaking strength shall be the average tensile breaking strength of the six briquettes for each period. The briquettes to be tested shall be held in strong metal jaws of the shape shown in Figs. 2 and 3, Plate 1, and the load steadily and uniformly applied, starting from zero, and increased at the rate of 100 lbs. per square inch of section in 12 seconds.

The breaking strength of the briquettes at 7 days after gauging shall be not less than 200 lbs. per square inch of section.

The breaking strength of the briquettes at 28 days after gauging shall show an increase on the breaking strength at 7 days and shall be not less than the number of pounds per square inch of section arrived at from the following formula :—

$$\text{Breaking strength at 7 days} + \frac{10{,}000 \text{ lbs.}}{\text{Breaking strength at 7 days.}}$$

Standard Sand.—The standard sand shall be obtained from Leighton Buzzard, be thoroughly washed and dried, and shall pass through a sieve of 20 × 20 meshes per square inch, and be retained on a sieve of 30 × 30 meshes per square inch. The sieves shall be prepared from wire cloth, the wires being ·0164 inch and ·0108 inch in diameter respectively. The wire-cloth shall be woven (not twilled), the cloth being carefully mounted on the frames without distortion.

Tests for Setting Time.

13. Unless a specially slow setting cement be required of which the minimum time of setting has been specified, the cement shall be of one of three distinct gradations of time of setting, designated as "Quick," "Medium," and "Slow."

Quick.—Initial setting time not less than two minutes.
Final setting time not less than ten minutes, nor more than thirty minutes.

Medium.—Initial setting time not less than ten minutes. Final setting time not less than 30 minutes, nor more than three hours.

Slow.—Initial setting time not less than thirty minutes. Final setting time not less than three hours, nor more than seven hours.

Vicat Needle Apparatus.—The initial and final setting times of the cement shall be determined by means of the Vicat needle apparatus shown on Plate 3.

For the purpose of carrying out the tests, a test block shall be made as follows:—

Neat cement shall be gauged in the manner and under the conditions referred to in Clause 11, and the gauging shall be completed before signs of setting occur. The test block shall then be made by filling the cement gauged as above into the Vicat mould shown at **E**, Plate 3, the mould resting upon a non-porous plate. The mould shall be completely filled, and the surface of the test block shall then be smoothed off level with the top of the mould.

Determination of Initial Setting Time.—For the determination of the initial setting time the test block confined in the mould and resting on the plate shall be placed under the rod bearing the needle, when the latter shall then be lowered gently into contact with the surface of the test block and quickly released, and allowed to sink into the same.* This process shall be repeated until the needle, when brought into contact with the test block and released as above described, does not pierce it completely. The period elapsing between the time when the cement is filled into the mould and the time at which the needle ceases to pierce the test block completely shall be the initial setting time above referred to.

Determination of Final Setting Time.—For the determination of the final setting time the needle (**C**) of the Vicat apparatus shall be replaced by the needle (**F**), shown separately on Plate 3. The cement shall be considered as finally set when, upon applying the needle gently to the surface of the test block, the needle makes an impression thereon, while the attachment shown in the figure on Plate 3 fails to do so. In the event of a scum forming on the surface of the test block, the underside of the test block may be used for determining the final set.

*The Vicat Needle may, if desired, be fitted with a mechanical attachment such as a "Gravesend," so as to ensure the steady and gentle application of the point of the needle to the surface of the test block, and thereby render the test independent of the hand of the operator.

Care must be taken that the needle rests with its full weight upon the surface of the test block.

Test for Soundness.

14. The cement shall be tested for soundness by the "Le Chatelier" method. The apparatus for conducting the "Le Chatelier" test is shown on Plate 4. The moulds shall be kept in good condition, having the jaws not more than 0·5 mm. apart.

In conducting the test the mould shall be placed upon a small piece of glass and filled with cement gauged in the manner and under the conditions referred to in Clause 11, care being taken to keep the edges of the mould gently together whilst this operation is being performed. The mould shall then be covered with another glass plate, upon which a small weight shall be placed, and the whole shall then be immediately submerged in water at a temperature of 58 to 64 degrees Fahrenheit, and left there for 24 hours.

The distance separating the indicator points shall then be measured, and the mould again submerged in water at 58 to 64 degrees Fahrenheit, which shall be brought to boiling point in 25 to 30 minutes and kept boiling for six hours. The mould shall then be removed from the water and allowed to cool and the distance between the points again measured; the distance between the two measurements represents the expansion of the cement. When the sample has been aerated for 24 hours in the manner described in Clause 7, the expansion as above determined shall not exceed 10 millimetres. In the event of the cement failing to comply with this test a further test shall be made from another portion of the same sample after it shall have been aerated for a total period of 7 days in the manner before described when the expansion determined as above shall not exceed 5 mm.

Non-Compliance with Tests.

15. Any cement which does not comply with the whole of the tests and analyses hereinbefore specified may be rejected as not complying with this Specification.

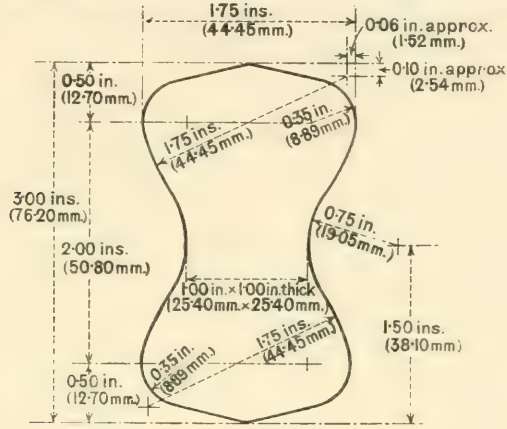
Copies of Vendor's Tests and Analyses, &c.

16. The Vendor shall, if required, furnish free of cost a copy of any document in his possession showing the result of any tests or analysis made for him or for any other person of any cement sold or offered for sale to the Purchaser or of the lot from which the cement so sold or offered for sale has been or is to be taken, and shall, if required, furnish, free of cost, a certificate that the cement so sold or offered for sale has been tested and analysed, and that such tests and analysis comply in all respects with this Specification, but the furnishing of such copies of documents or the giving of such certificate shall not preclude the Purchaser from rejecting any cement which does not comply with this Specification.

Delivery.

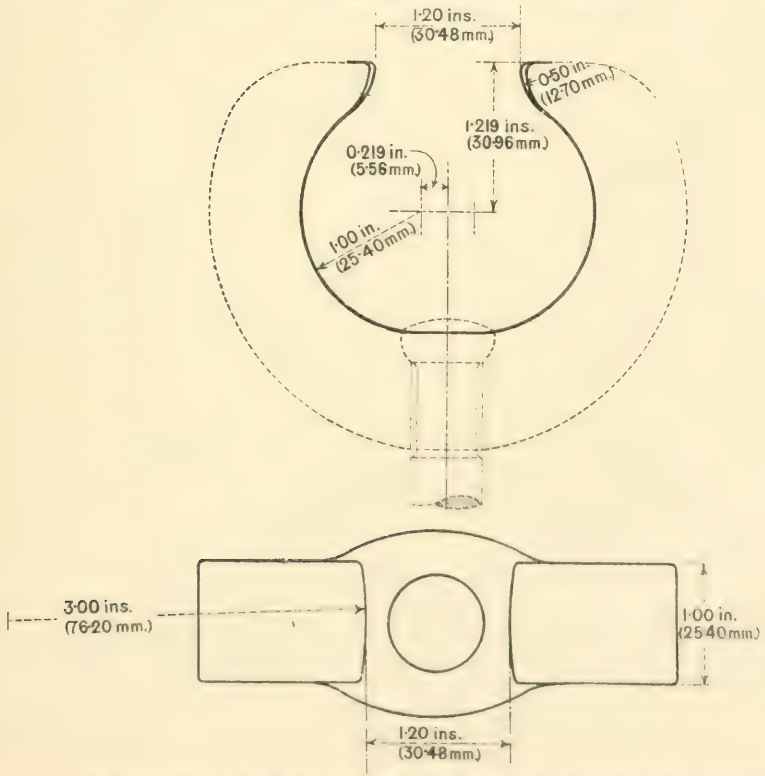
17. Cement shall be delivered in bags, barrels or other packages, bearing the Manufacturer's name. A Purchaser desiring to have the cement delivered in bags, barrels or packages sealed or of any particular size must so specify at the time of ordering.

BRITISH ENGINEERING STANDARDS ASSOCIATION.



Briquette to have an uniform thickness of 1 inch throughout.

Fig. 1. Dimensions of Standard Briquette.

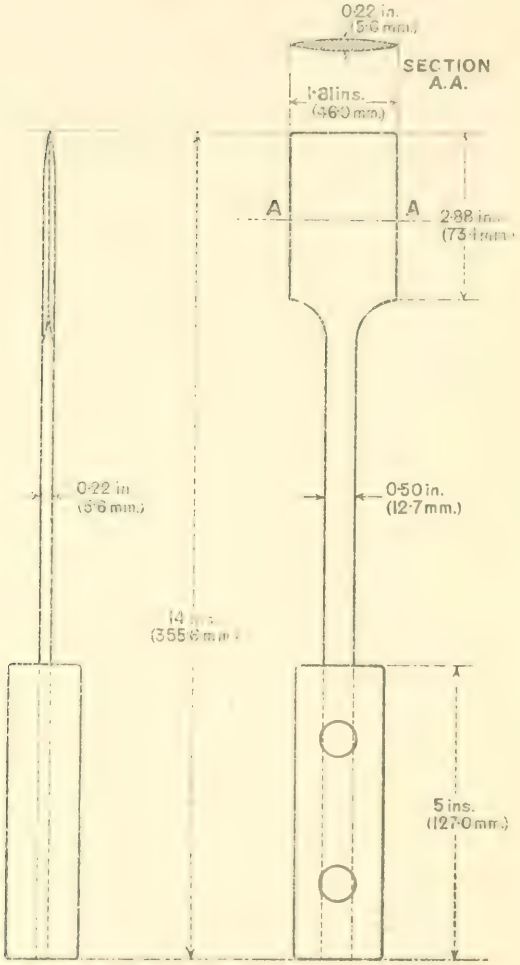


Figs. 2 and 3. Elevation and Plan of Jaws for Holding Briquette.

Note.—The figures in brackets are approximate equivalents.

BRITISH ENGINEERING STANDARDS ASSOCIATION.

STANDARD SPATULA.

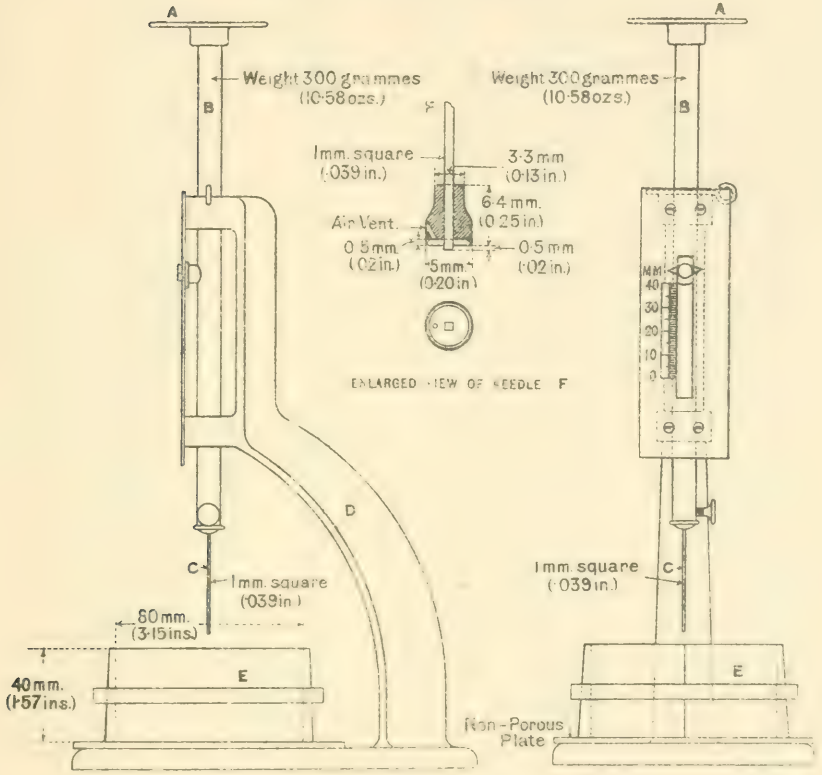


The Standard Spatula shown above is of steel with a wooden handle secured rivetted on. The total weight shall not exceed 12 ozs. (340 grammes), and the centre of gravity shall fall within 0·25 inch (6·4 mm.) of the centre of the length of the spatula.

Notes [illegible] equivalents.

BRITISH ENGINEERING STANDARDS ASSOCIATION.

VICAT NEEDLE APPARATUS FOR ASCERTAINING SETTING TIME OF CEMENT.



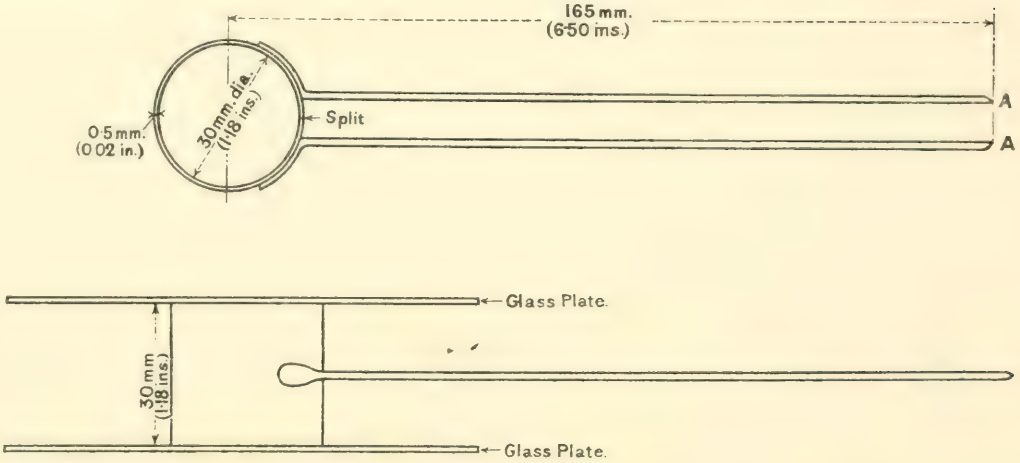
The Vicat Needle Apparatus consists of a frame (**D**) bearing a movable rod (**B** with the cap (**A**) at one end and the removable needle (**C**) at the other. The needle shall be 1 mm. (·039 inch) square in section and have a flat end. The rod (**B**) carries an indicator which moves over a graduated scale attached to the frame (**D**). The cap, rod and needle with all attachments shall together weigh 300 grammes (10·58 ozs.). The mould for the cement consists of a split ring (**E**) 80 mm. (3·15 inches) in diameter, 40 mm. (1·57 inches) high, which rests on a non-porous plate.

For the determination of the final setting time the needle (**C**) is replaced by the removable needle (**F**) of the same shape and section, but fitted with a metal attachment hollowed out so as to leave a circular cutting edge 5 mm. (0·20 inch) in diameter, the end of the needle projecting 0·5 mm. (·02 inch) beyond this edge. The needle with attachment, the cap (**A**) and rod (**B** complete as above described must together weigh 300 grammes (10·58 ozs.).

Note.—The figures in brackets are approximate equivalents.

BRITISH ENGINEERING STANDARDS ASSOCIATION.

APPARATUS FOR CONDUCTING THE "LE CHATELIER" TEST.



The apparatus for conducting the "Le Chatelier" test consists of a small split cylinder of spring brass or other suitable metal of 0·5 millimetre (·02 inch) in thickness, forming a mould 30 millimetres (1·18 inches) internal diameter and 30 millimetres 1·18 inches, high. On either side of the split are attached two indicators with pointed ends **A.A.**, the distance from these ends to the centre of the cylinder being 165 millimetres (6·50 inches).

Note.– The figures in brackets are approximate equivalents.

BRITISH ENGINEERING STANDARDS ASSOCIATION.

SPECIFIC GRAVITY BOTTLE.

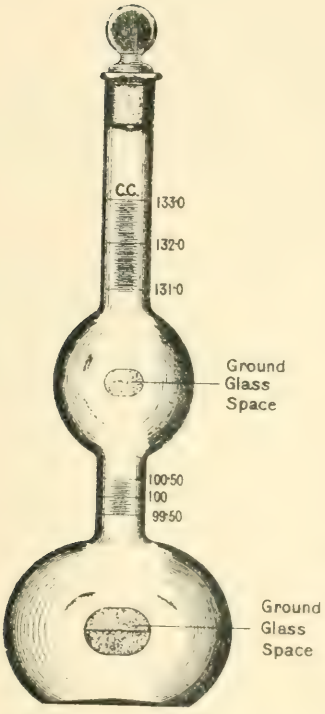


FIG. 1.

DIRECTIONS FOR USE.

Insert in the bottle, by means of a pipette, without wetting the interior above the lower neck, 100 c.c. (approximately) of petroleum, paraffin or other suitable liquid which has been freed from water. Place the bottle with the contained liquid in a tank of water of known temperature between 58° and 64 Fahr. and allow it to remain there until the level of the liquid in the bottle remains constant, owing to its having attained the same temperature as the tank water. Read the level of the liquid in the bottle from the bottom of the meniscus and make a note of the reading on the ground glass space provided for the purpose on the lower bulb. In the sketch (Fig. 2) the reading is 99·8 c.c.

Now insert in the bottle, through a funnel, 100 grammes (accurately weighed) of the cement to be tested. Insert the stopper and tap the bottle carefully on a rubber or other soft pad to bring the bubbles of air to the surface. Replace the bottle in the tank, the water of which must be at the same temperature as in the case of the first reading, and when the level remains unchanged, again take a reading from the bottom of the meniscus. In the sketch (Fig. 3) this reading is 132 c.c.

The specific gravity is then obtained as follows :—Deduct 99·8 c.c., the original volume of the liquid, from 132 c.c. which gives 32·2 c.c. as the volume occupied by 100 grammes of cement.

Then the Specific Gravity of the Cement $= \frac{100}{32 \cdot 2} = 3 \cdot 105$.

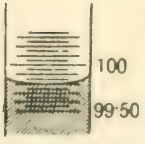


FIG. 2.

FIG. 3.

British Engineering Standards Association.

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JANUARY, 1919.

(This List cancels all previous Lists.)

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